Fundamental Optics, THz & Optical Nanostructures

Tools & Techniques

Numerical Design tools: finite difference time domain, rigorous coupled wave analysis, finite element.

Fabrication tools: photo-, e-beam, interference- lithography and wet or dry etching methods.

Optical spectroscopy tools: linear and nonlinear techniques with 1 μm spatial-, sub-nanosec time-, 0.1 nm wavelength- resolution.

Welcome to Foton lab: Plasmonics and Photonics Activity

In the Foton lab we are active in the areas of Plasmonics and Photonics. We investigate light modulation and control of optical properties in nanopatterned metal-dielectric and dielectrics. Broadband response is of particular interest.

Nanopatterns conforming to crystals, quasicrystals or aperiodic patterns are designed to have unique properties. We fabricate and study these structures.

We study light localization for quantum information processing, controlling light emission and light modulation for nanophotonic and optical planar integrated circuits and modulation of optical properties of materials.

CURRENT MEMBERS:

Prof. Achanta Venu Gopal, Gajendra Mulay, Dr. Nageswara Rao, Y.V. Jayasurya, Ajith P.R., Banoj Kumar Naik, Richa Goel

1 PhD position available

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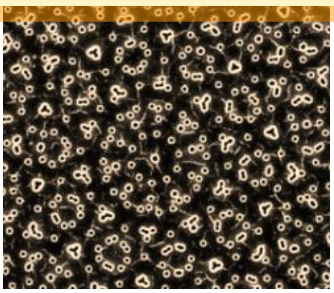
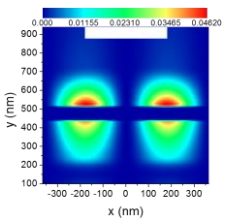
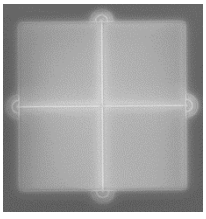


Plasmonic Quasicrystal air hole pattern



FDTD simulation results showing field localization at the interface.



Cross waveguides having a single quantum dot at the intersection

Metamaterials (Plasmonic)

Surface plasmon polaritons (SPPs) are charge density waves at the metal-dielectric interface. SPP excitation and resultant strong local field is useful for manipulating the optical properties of materials and light itself. We design, fabricate and study metal-dielectric structures.

With emphasis on light harvesting, broadband and near dispersionless plasmon excitation is demonstrated in plasmonic crystals and quasicrystals.

We demonstrated plasmon mediated giant enhancement of magneto-optical properties. Enhanced light emission from semiconductors and light modulation in plasmonic crystals are some of the topics we are currently working on.

Light reflected at an interface experiences various shifts like Goos-Hanchen, Imbert-Federov and angular shifts. We designed and demonstrated structures that exhibit giant plasmon mediated beam shifts.

Dielectric structures

Photonic crystals, periodic dielectric structures, are actively pursued. PC cavities with quantum dot defects are studied for quantum information processing.

All dielectric metamaterials conforming to Reflectionless potentials are demonstrated for broadband reflectionless transmission.

Cross waveguides about single quantum dots demonstrated for measuring the complete polarization state of the emitted light.